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AUTHOR Kanetzke, Carol A.
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ABSTRACT

The effects of Dynamic Range of Motion (D'ROM) exercises and static stretch on hip flexibility and hip strength were examined. One hundred one male and female college students were divided into three groups: D'ROM, static stretch (ST), and control (C). All subjects were measured before and after treatment for hip flexibility and strength. Two specific hip flexibility exercises were performed twice a week for seven weeks by the D'ROM and ST groups. The gain scores of the dependent variables, hip flexibility and strength, were each analyzed by a two-way analysis of variation (sex x treatment). Zero-order and partial correlation coeffients were calculated between flexibility and strength for pretest, posttest, and gain measures for all groups. D'ROM had a significantly greater increase of hip flexibility than ST and C, and a significantly greater increase of hip strength than C. Females had a significantly greater increase of hip strength than males. Results indicate that D'ROM exercises have an effect on developing flexibiity and strength at the hip joint. Increases in hip strength may not be related to increases in hip flexibility for both D'ROM exercises and static strength. Exercises are illustrated, and tables and charts are also included. (Author/JD)

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THE EFFECTS OF DYNAMIC RANGE OF MOTION EXERCISES AND STATIC STRETCHING ON STRENGTH AND RANGE OF MOTION OF THE HIP JOINT

Abstract

CAROL A. KANETZKE

The effects of Dynamic range of motion exercises and static stretch on hip flexibility and hip strength were examined. One-hundred and one college-age male and female students were divided into three groups: Dynamic range of motion (D'ROM)(n=32), static stretch (ST)(n=34), and control (C)(n=35). All subjects were measured before and after treatment for hip flexibility, using a Leighton flexometer, and for hip strength, using a cable tensiometer. Treatment consisted of two specific hip flexibility exercises performed twice a week for seven weeks by the D'ROM and ST groups. The gain scores of the dependent variables, hip flexibility and hip strength, were each analyzed by a two-way ANOVA (sex x treatment). Tukey's HSD test was used for all pairwise comparisons. Zero-order and partial correlation coefficients were calculated between flexibility and strength for pretest, posttest, and gain measures for all groups, including a pooled D'ROM-ST group (D-S). D'ROM had a significantly greater increase of hip flexibility than ST ($p<.05$) and C ($p<.05$). D'ROM had a significantly greater increase of hip strength than C ($p<.05$). Females had a significantly greater increase of hip strength than males

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($p<.05$). Interaction was not significant. Significant partial correlations ($p<.05$), controlling for sex, were found for ST (.605) and D-S (.438) for pretest measures. A significant zero-order correlation ($p<.05$) was found for D'ROM (-.385) for posttest measures. D'ROM exercises have a significant effect on developing flexibility and strength at the hip joint. Increases in hip strength may not be related to increases in hip flexibility for both D'ROM exercises and static stretch.

PURPOSE

The major focus of this study was to compare the effects of static stretch exercises and dynamic range of motion exercises (D'ROM) on hip flexibility and hip strength. The relationship between hip flexibility and hip strength was also examined.

HYPOTHESES

The following hypotheses were investigated:

1. There is no significant difference in mean gain scores of hip flexibility among the static, D'ROM, and control groups.

2. There is no significant difference in mean gain scores of hip strength among the static, D'ROM, and control groups.

3. There is no significant difference in mean gain scores of hip flexibility between males and females.

4. There is no significant difference in mean gain scores of hip strength between males and females.

5. There is no significant difference in the relationship of hip flexibility and hip strength between the static and D'ROM groups.

6. There is no significant difference in the relationship of hip flexibility and hip strength between the pooled D'ROM-static experimental group and the control group.

METHODOLOGY

1. One hundred and nine college-age male and female students enrolled in three sections of social dance classes at South Dakota State University volunteered to participate as subjects in this study. Each section was randomly assigned to one of three treatments:

a.	D'ROM	16 females, 16 males
b.	Static Stretch	16 females, 18 males
c.	Control	17 females, 18 males

2. All subjects were measured for range of motion of the hip, using a Leighton flexometer (see Figure 3), and hip strength, using a cable tensiometer (see Figure 4), preceding and proceeding treatment.

3. Intraclass reliability was established when 29 of the subjects were randomly chosen to be tested on two consecutive days during either the pretest or posttest.

4. Treatment consisted of the D'ROM group performing two hip flexibility exercises as described by Gajda[1] (see Figure 5), and the static stretch group performing two hip flexibility exercises as described by Anderson[2] (see Figure 6).

5. Both groups exercised twice per week for a period of seven weeks. Each exercise was performed a total of five repetitions with the right leg and then repeated with the left leg. The control group did not partake in any of the designated exercises.

6. All instructions for the exercises were taped and were played at the beginning of the class period. A metronome was used in constructing the tape so that all exercises were synchronized within groups and between groups.

7. The difference score, from the pretest to the posttest, was used as the criterion value in the analysis of the data. Each dependent variable, hip strength and hip flexibility, was analyzed by a two-way ANOVA (sex x treatment). Tukey's HSD test was then utilized to test all pairwise comparisons. A probability level of $p<.05$ was established as the sifnificance level of all analyses.

8. Zero-order and partial correlation coefficients (controlling for sex) were calculated for all groups, including a pooled D'ROM-static group, between pretest flexibility and strength measures, posttest flexibility and strength measures, and gain scores of flexibility and strength. The resulting relationships were then examined.

FINDINGS

Analyses of the data resulted in the following findings:

1. Intraclass reliability coefficients of .875 and .969 were found for pretest measures of flexibility and strength, respectively (see Table 1). Reliability coefficients of .987 for flexibility and .790 for strength were computed for posttest measures (see Table 2).

2. The D'ROM group had significantly greater increases in range of motion of the hip joint, with a gain of 9.37 degrees, than either the static or control groups, with gains of 1.07 and 1.50 degrees, respectively (see Table 4, Figure 1).

3. The D'ROM group had significantly greater increases in hip strength than the control group, with gains of 18.23 and 5.19 pounds, respectively. No significant difference was found between the D'ROM group and the static group, which had a gain of 9.92 pounds, or between the static group and control group (see Table 5, Figure 2).

4. Females had significantly greater increases in hip strength than males with a gain of 16.01 and 6.11 pounds, respectively (see Table 5). No significant difference was found between sexes in gain scores of flexibility (see Table 4).

5. A significant partial correlation coefficient was found between flexibility and strength in pretest measures for the static group (.605) and the pooled D'ROM-static group (.438). A significant zero-order correlation coefficient was found in posttest measures for the D'ROM group (-.385). All other correlations for pretest, postest, and gain score measures were found to be insignificant for all groups (see Table 3).

CONCLUSIONS

On the basis of the results, the following conclusions have been made:

1. D'ROM exercises are more effective than static stretch in increasing flexibility of the hip joint, during a seven week period when exercising two times per week.

2. The D'ROM exercises have a significant effect upon strength development at the hip joint.

3. D'ROM exercises may be a more time-efficient warm-up method than static stretches since flexibility and strength are developed simultaneously.

4. Increases in strength are not necessarily related to increases in flexibility with D'ROM and static stretch exercises.

5. D'ROM exercises may decrease the resistance of the soft tissues surrounding the joint as well as increasing the strength of the opposing muscle group.

TABLE 1

Pretest Retest Reliability Measures

Measure	Mean	SD	n	Reliability
First Day Flexibility	87.60	10.66	15	.875
Second Day Flexibility	93.75	11.14	15	
First Day Strength	95.34	43.20	15	.969
Second Day Strength	95.11	40.61	15	

TABLE 2

Posttest Retest Reliability Measures

Measure	Mean	SD	n	Reliability
First Day Flexibility	87.40	12.96	15	.987
Second Day Flexibility	87.59	13.41	15	
First Day Strength	102.16	29.97	14	.790
Second Day Strength	97.37	23.30	14	

Note. Mean square within subjects was used as the error term in the computation of intraclass reliability.

TABLE 3

Zero-order and Partial Coorelation Coefficients
of Hip Flexibility and Strength Measures

Group	Pretest Measures		Posttest Measures		Gain Measures	
	Zero	Partial	Zero	Partial	Zero	Partial
D'ROM n=32	-.021	.242	-.385*	-.312	.012	.005
Static n=34	.316	.605*	.172	.309	.058	.079
Control n=35	.262	.297	.117	.172	.098	.050
Pooled D'ROM-static n=66	.168	.438*	-.021	.087	.122	.147

* p .05

TABLE 4

Means and Standard Deviations for Pretest, Posttest, and Gain Scores of Flexibility Measures

Group	Pre Mean	Pre SD	Post Mean	Post SD	Gain Mean	Gain SD
D'ROM n=32	84.82	13.58	94.19	13.19	9.37	7.01
Static n=34	86.32	15.98	87.39	16.16	1.07	8.39
Control n=35	84.60	10.72	86.10	11.31	1.50	6.52
Females across groups n=49	88.07	12.44	91.80	14.22	3.73	8.30
Males across groups n=52	82.59	13.95	86.55	13.42	3.96	8.18

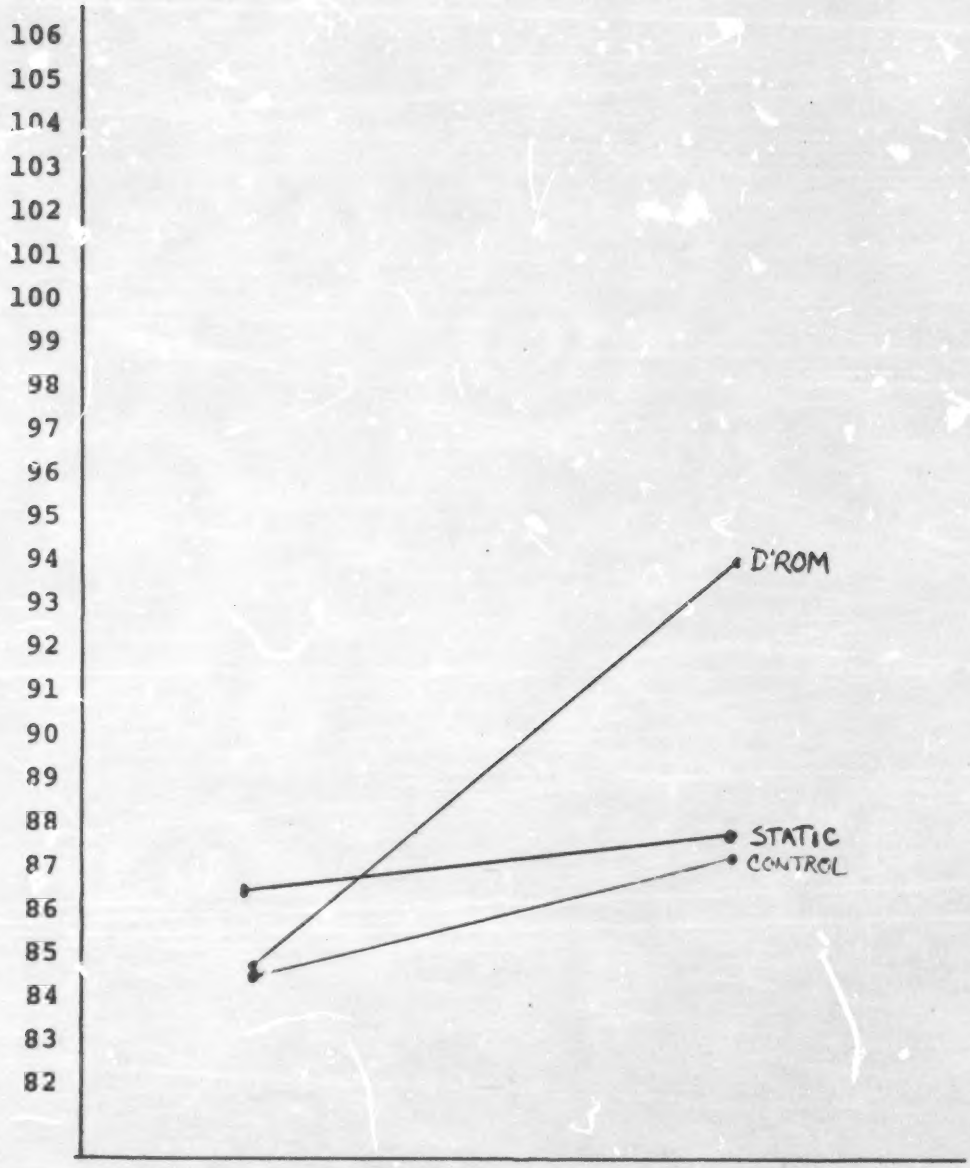
Note. All measures are reported in degrees of flexion.

TABLE 5

Means and Standard Deviations for Pretest, Posttest, and Gain Scores of Strength Measures

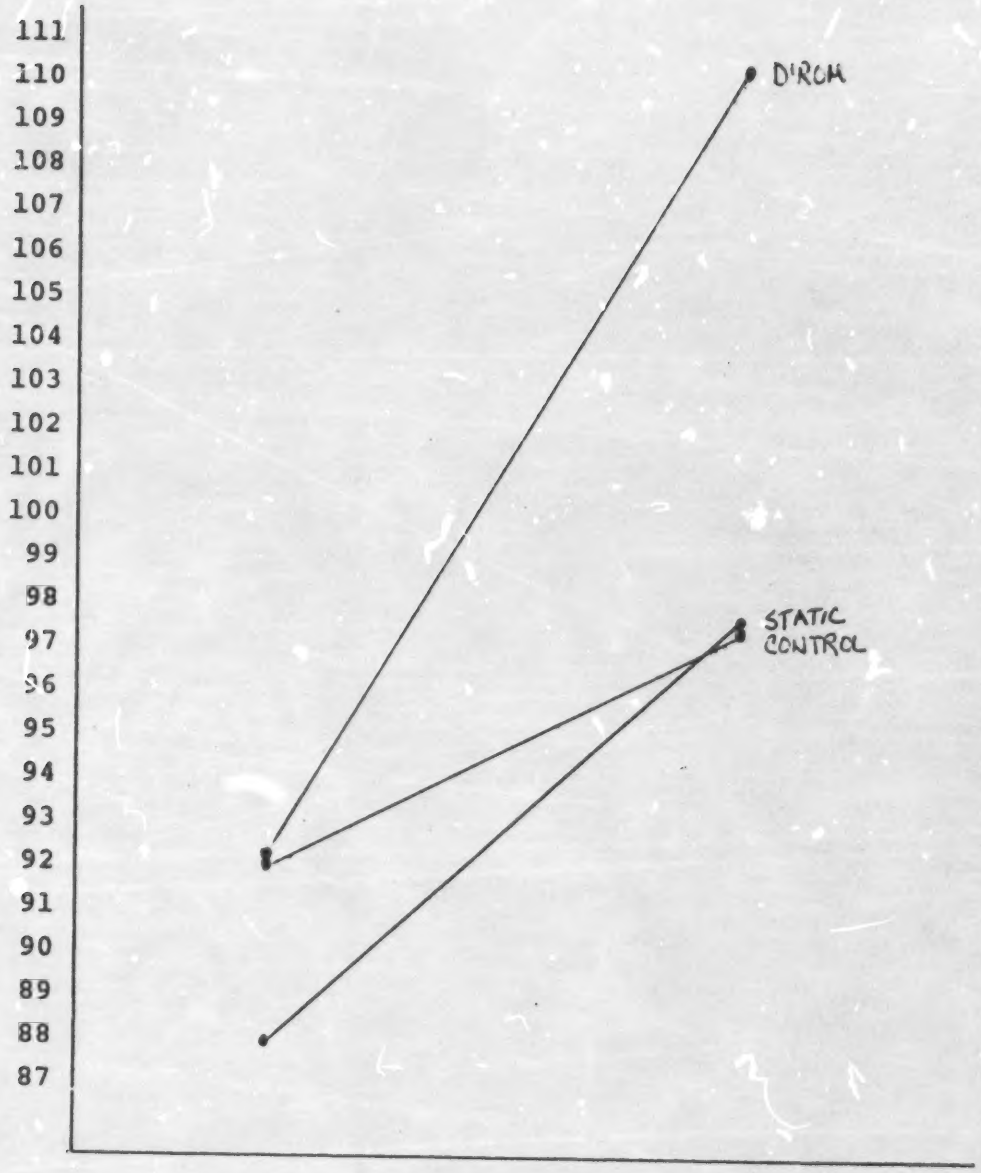
Group	Pre Mean	Pre SD	Post Mean	Post SD	Gain Mean	Gain SD
D'ROM n=32	92.09	29.71	110.32	31.28	18.23	22.03
Static n=34	87.53	31.95	97.45	30.94	9.92	22.56
Control n=35	92.06	33.99	97.25	33.62	5.19	13.36
Females across groups n=49	70.55	20.12	86.56	32.33	16.01	22.56
Males across groups n=52	109.39	29.21	115.50	25.30	6.11	20.16

Note. All measures are reported in pounds exerted.



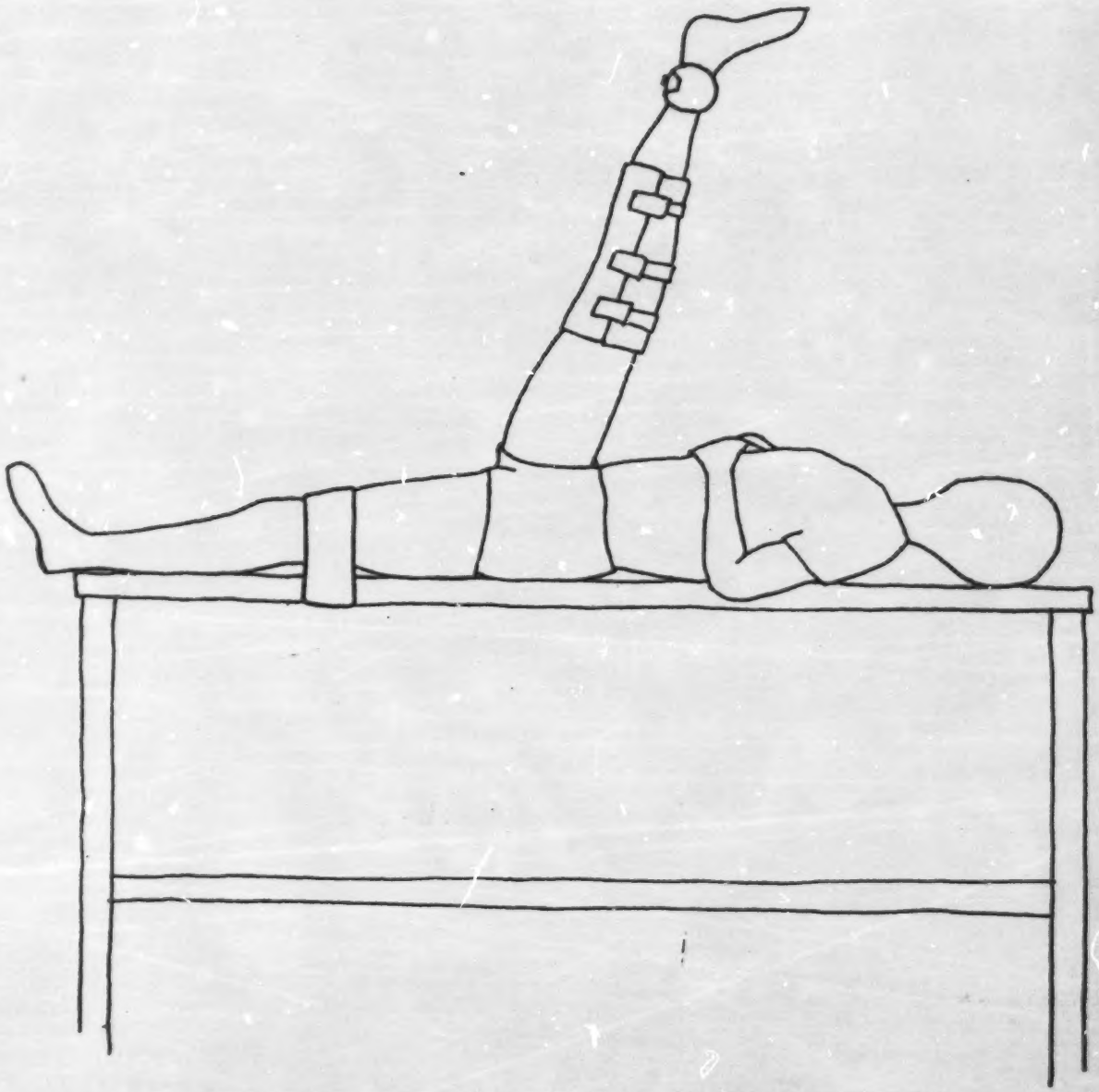
PRETEST AND POSTTEST MEANS OF FLEXIBILITY MEASURES

FIGURE 1



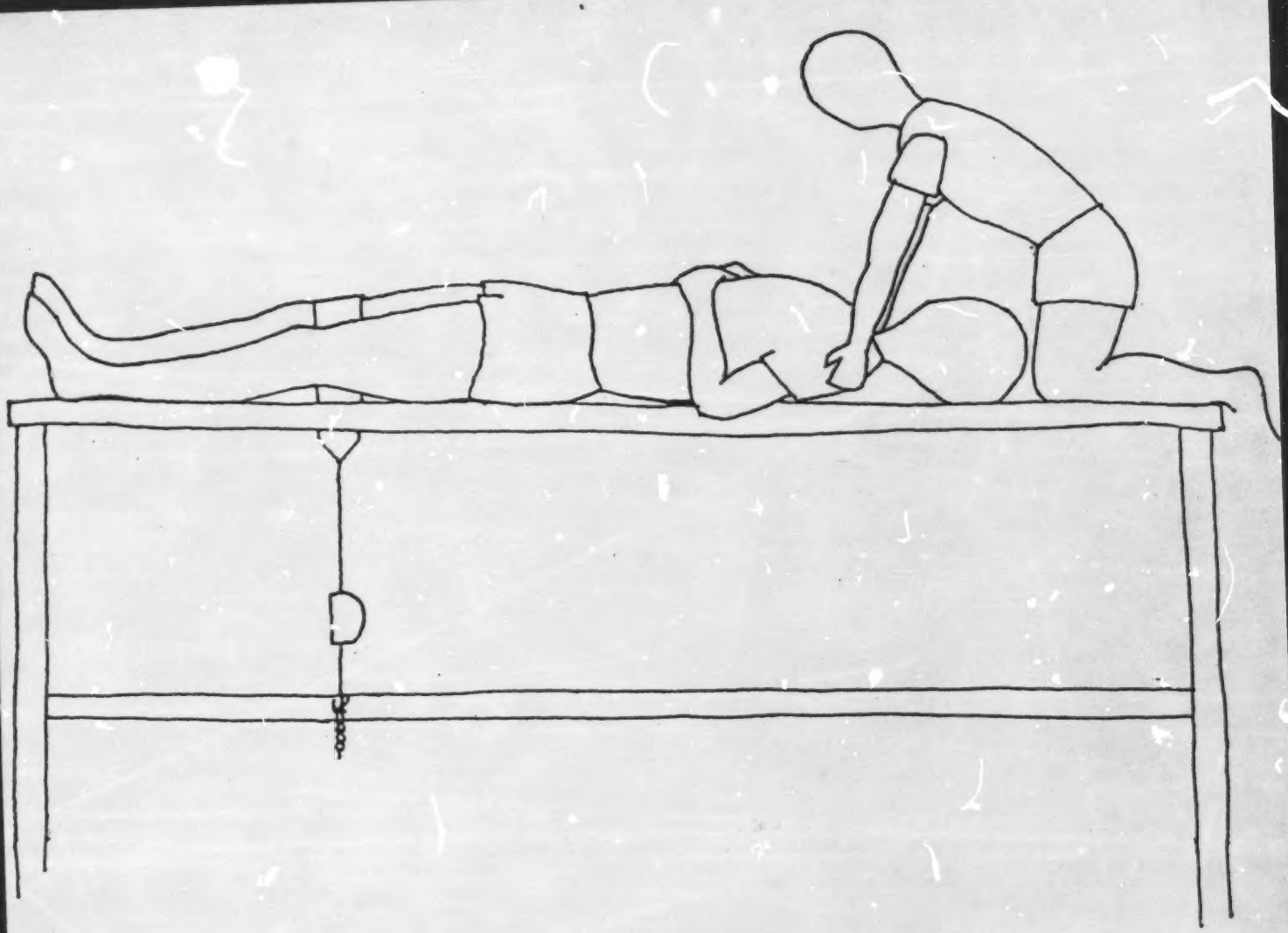
PRETEST AND POSTTEST MEANS OF STRENGTH MEASURES

FIGURE 2



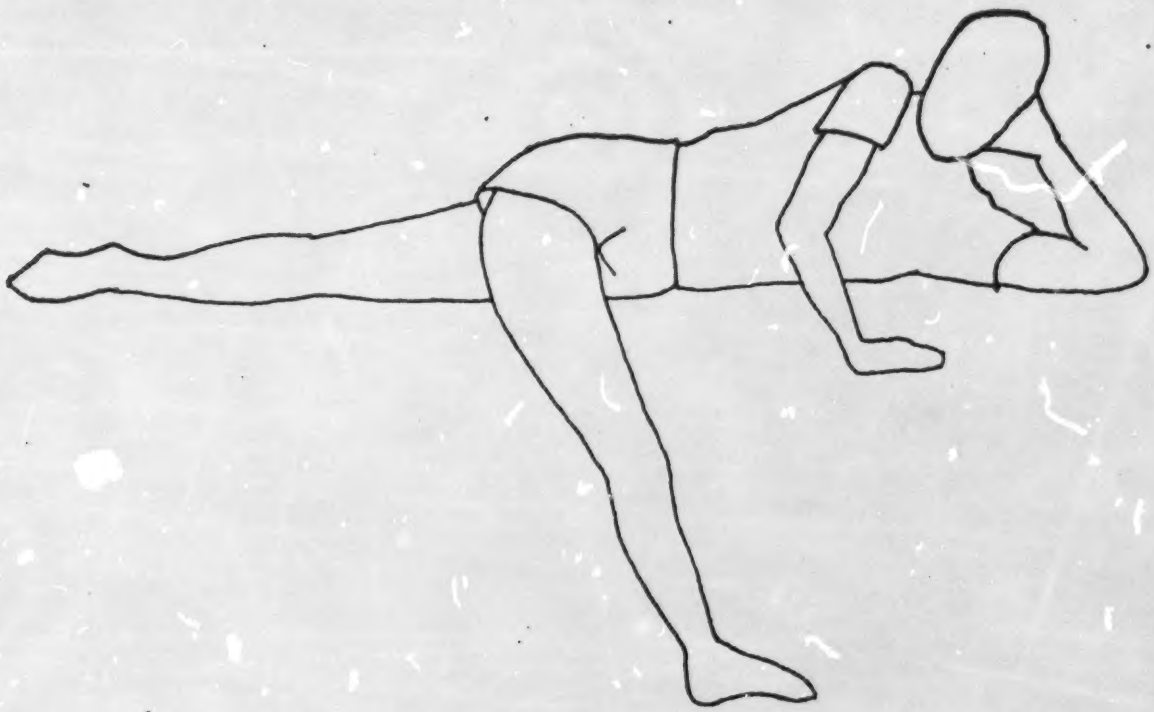
PROCEDURES FOR MEASURING FLEXIBILITY

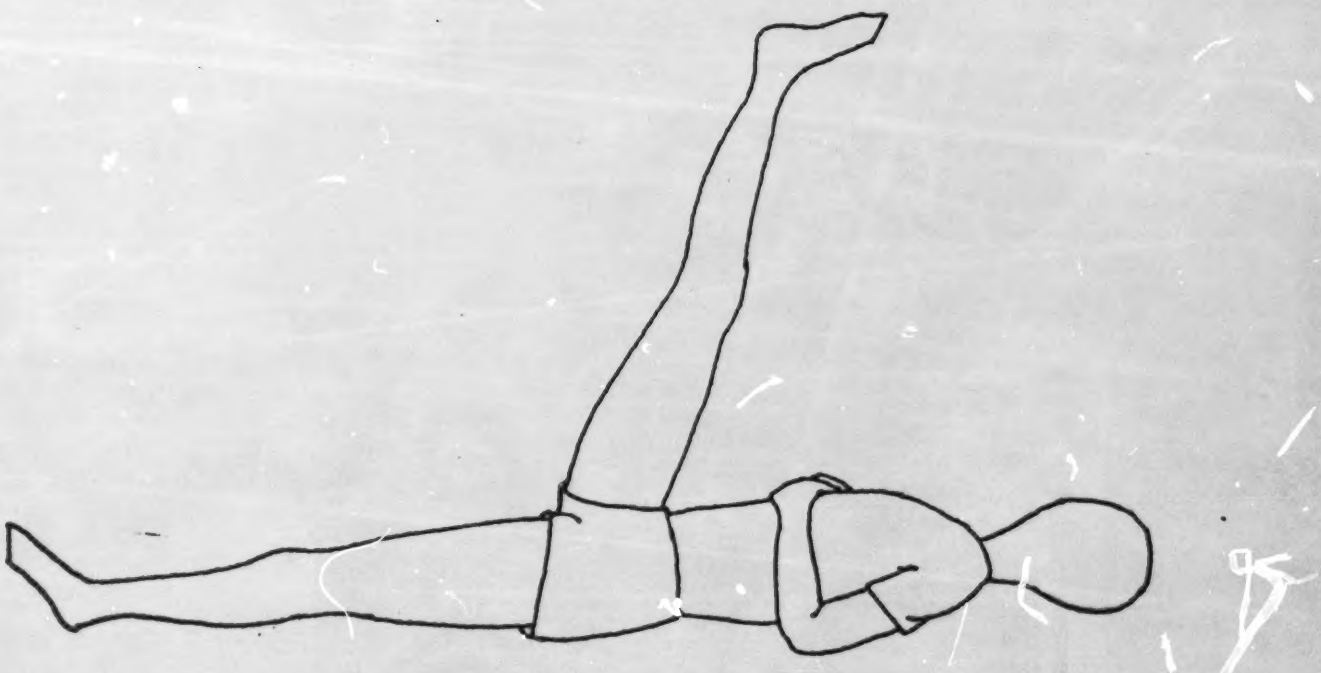
FIGURE 3



PROCEDURES FOR MEASURING STRENGTH

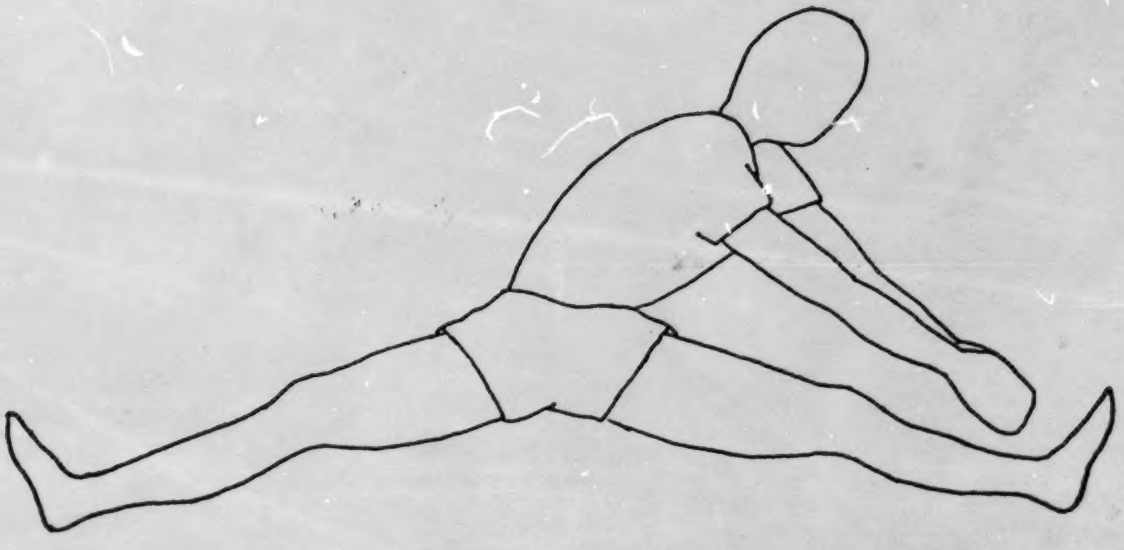
FIGURE 4





DYNAMIC RANGE OF MOTION EXERCISES

FIGURE 5



STATIC STRETCH EXERCISES

FIGURE 6